ABSTRACT

Photovoltaics is a portentous alternative to the nonrenewable energy resources. Organic solar cells (OSCs) offer several advantages over inorganic counterparts in terms of low-cost device production, simple solution-based processing, flexibility, light-weight and compatibility with roll-to-roll fabrication. This review comprehensively examines the latest research developments towards high-performance OSCs. Device processing conditions and engineering along with material developments for the active and interfacial layers are examined. Different device structures and their benefits and limitations are highlighted. The interfacial layer materials including the polymers and metal oxides together with their integration and performance in functional OSCs are examined. A salient aspect of this review is the design of donor and acceptor materials to address the optical and electronic properties requirement for optimized device efficacy of OSCs. In this regard, the prospects of tailoring the band gap of donor polymers alongside the adoption of non-fullerene acceptors with complementary optical absorption for improved solar energy harvesting is elucidated. Further, graphene's feasibility as an active or interfacial layer material is reviewed. Hence, this article provides perspectives and strategies on further development of solution-processable donor, acceptor and interfacial materials for high efficiency devices, required in commercialization of OSCs.

Keywords

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